

## Western Flower Thrips

*Frankliniella occidentalis*

by L. Irene Terry<sup>1</sup>



Photo from Dr. Tamosu Mura

Comparison of thrips life stages: larval to adult (adults darker colored and winged).

### Do You Know?

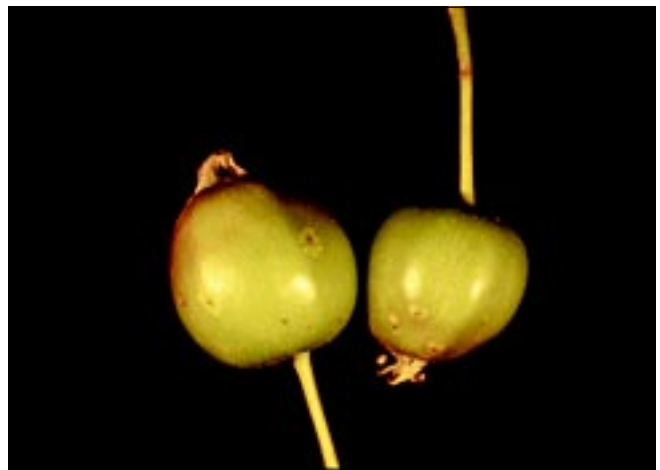
- u Western Flower thrips are found on numerous weed and crop hosts and can rapidly move into apple blossoms during bloom.
- u The damage is caused when a female lays an egg into fruit buds or young fruitlets. A large halo or 'pansy spot' can form.
- u This cosmetic damage is found primarily on the 'Granny Smith' and other light-skinned cultivars.
- u A white stippling type damage occurs on nectarines.
- u Monitoring method: shake thrips out of a blossom cluster and count adult females.
- u Management: late petal fall stage is the most effective time to treat to minimize thrips damage, but thrips densities and other factors should be considered before treating.

Western flower thrips are native to western North America and are widespread throughout this region. This species feeds on hundreds of different weed and crop hosts. Western flower thrips can rapidly build up during bloom on all apple cultivars, and are especially abundant in the warmer areas of the Mountain West. These warmer areas generally have other crop and weed hosts that serve as reservoirs during the late winter and early spring, from which thrips rapidly emigrate to the more attractive and abundant resources of apple blossoms. This thrips species can cause cosmetic damage to apple fruit which lowers the grade of apples. Primarily the green-skinned 'Granny Smith' is the cultivar that is blemished, but blemishes can also occur on 'Ginger Gold'. All stages of thrips except pupae are found on the blossoms, but it is the adult female that causes the damage when she oviposits into the developing bud or fruitlet.

Thrips are a group of tiny, elongated, and fringe-winged insects that are commonly found in flowers of most plants.



Thrips injury (pansy spot) on mature 'Granny Smith' apple.



Thrips injury (pansy spot) on young 'Ginger Gold' apples.

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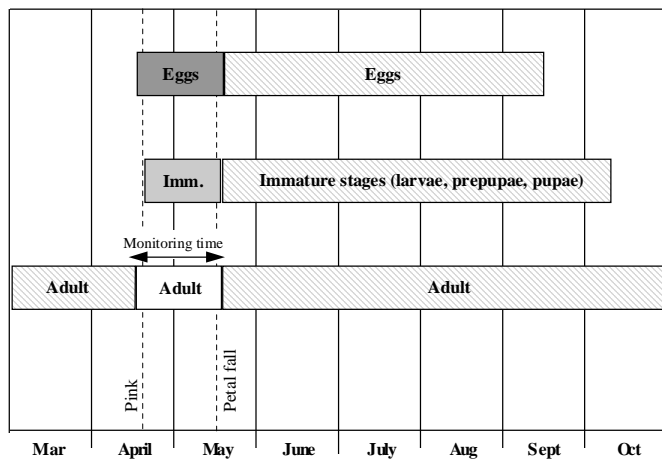
Many feed on plant tissues as well as pollen. They feed by a “punch and suck” method, whereby they push their mouth cone into plant tissue or pollen, and then suck the contents through their straw-like stylets. A few species of thrips are now worldwide pests, and one of these is the western flower thrips. In this region, western flower thrips damages not only apples but also many horticultural and field crops, such as tomatoes and cotton. Even though western flower thrips can transmit plant viruses to some crops, apples are not affected.


## Hosts

apple	alfalfa
nectarine/peach	pistachio
plum	strawberry
grapes	many crops and weeds
tomatoes	

## Life History

### Western Flower Thrips Life History



 Denotes part of life cycle spent on host other than apples.  
 • Thrips infest apples only during the bloom period (pink through petal fall).

Western flower thrips have several developmental stages: egg, first and second instar larva, prepupa, pupa, and adult. It infests apples only during the bloom period, although an occasional adult or larva may be found on leaves after bloom is over. All life stages can be found in apple blossoms during bloom, except the prepupa and pupa, which drop to the ground to pupate.

## Adult

Adult western flower thrips can be distinguished from other insects by their fringed wings, their tubular body shape and color (Fig. 1)

### Female—Damage Causing Stage

- u **Size, color, and shape:** Females are about 1/25 of an inch long and have many color forms. These vary from pale yellow thorax and abdomen to yellow thorax and dark abdomen to very dark color throughout their body. In higher elevations, females are black. Wings are fringed on the margins and are clear to yellow in color. (Fig. 1)
- u **Where:** The female feeds on tissues of the apple blossoms and pollen.
- u **When:** During pink through petal fall of the apple bloom period.
- u **Behavior:** Females usually mate once, and then not again for several weeks, presumably after the stored sperm from the first mating is depleted or no longer effective. A female can lay >100 eggs depending upon the nutritional quality of her hosts. The female uses her saw-like ovipositor to insert eggs into plant tissue. Damage occurs when she oviposits into the young bud or fruitlet. Females do not have to mate before they can lay eggs.

### Male—Non-damaging Stage

- u **Size, color, and shape:** Smaller than the females (about 2/3 the female length). Males are all light yellow throughout their body. Wings are clear and yellow like those of the female (Fig. 1).
- u **Behavior:** Usually sexes co-occur in the blossoms, but males can form large aggregations on blossoms, where they mate with females that land on the flowers to look for food and oviposition sites. The males feed on flowers and pollen.

### Egg- Damaging Stage

- u Eggs are laid into leaf, bud, and floral tissues of apple during the bloom and early fruit set period. Eggs can only be seen through a microscope unless the area around the egg forms a damaging scar on the vulnerable fruitlet or bud. This damage is visible in young fruitlets.
- u Unfertilized eggs develop into males and fertilized ones are females.

## Larvae

- u First instar larvae molt to second instars in 1 to 10 days and second instars molt into pre-pupa in 3 to 14 days depending upon temperatures.
- u Larvae generally stay in the flower to feed on pollen and nectar, although they will move between different blossom clusters.
- u **Size, color, and shape:** About 1/50 inch long and 1/75 inch wide, translucent white to yellow, and tubular in shape (Fig. 1).
- u Larvae can be mistaken for leafhopper and Campylomma nymphs, which are about the same size

and color. However, thrips larvae are more elongate and worm-like.

u **Where:** Although very mobile, larvae will remain in the blossom clusters (all stages of blossom development) while pollen is available.

u **When:** Larvae begin to hatch from eggs within 4 to 15 days after adults move into blossoms and are found throughout the bloom period.

## Host Injury

u The damage is a surface blemish formed at the oviposition site, which is first observed on the developing fruitlets. The fruitlet or floral bud reacts to the egg being inserted into the apple skin which will scar. These scars become large extended halos or “pansy spots” with a central russet area; and occasionally, dimples will form on the fruitlet. As the apple enlarges and cells expand, the affected area enlarges (Figs. 2 and 3).

u Eggs are laid on buds and fruitlets of all cultivars; however, primarily the green-skinned apples, such as ‘Granny Smith’, are affected. Damage can also occur on ‘Ginger Gold’ and damage to some red-skinned cultivars, such as ‘McIntosh’ has been reported but is rare.

u Although this damage is only cosmetic, it can lower the fruit grade and thus reduce the value of the crop.

## Management

Because western flower thrips affect primarily ‘Granny Smith’, protective measures should focus on this cultivar. However, little is known about whether or not thrips will damage newer cultivars. Approaches to management include: monitoring and managing western flower thrips in areas adjacent to blocks of ‘Granny Smith’ prior to and during bloom; biological control; and pesticide sprays based on increasing thrips populations during late bloom. Early sprays may not be very effective for preventing damage and adversely affects natural enemies.

### Monitoring

Two methods can be used to monitor thrips: sticky traps and direct counts in blossoms of apples and other hosts.

**Sticky traps:** White, yellow, or blue sticky traps will attract and trap adult western flower thrips. Traps can be hung in branches of apple trees or on posts in fields adjacent to the crop. Trap captures indicate thrips movement into and within apples, but direct counts are better for estimating activity in the blossoms.

**Direct counts:** This method is somewhat less troublesome because it does not involve setting out traps. Blossoms of any plant can be shaken or flicked vigorously into a white cup (either styrofoam or plastic), even without removing the blossom from the plant. In apples, four blossom clusters per tree should be sampled on at least four trees for each block of trees and cultivar being evaluated. The larger and darker

adult female thrips can be distinguished from the smaller and lighter colored male. Blossom clusters with >5 female thrips are considered very high. However, studies setting action thresholds have given ambiguous results possibly because thrips densities can change rapidly within a day. Cold and wet conditions may cause thrips to move into warmer more protected hosts away from apples within a short period. Thrips move rapidly back into apple blossoms once good weather resumes. Also time of bloom should be considered (see below).

### Timing control

Studies testing whether to spray at a particular bloom period have been inconclusive. Some results indicate ‘pink’, others ‘petal fall’, and others still ‘peak bloom’ as the best time to use insecticides to prevent damage. Several complicating factors appear to affect the results. Thrips numbers at a particular bloom stage varies from year to year, and counting both sexes of thrips may lead to an inaccurate assessment of adult female numbers. The time during bloom when fruit is set varies. Egg laying habits also vary throughout bloom. Some studies showed that most eggs (>90- 95%) were laid in locations that did not cause fruit damage: such as leaves, leaf buds, blossom stems, blossom petals, etc., and that the locations vary with bloom stage. Therefore, timing sprays based upon a specific bloom stage are not recommended. Decisions to treat for thrips should be based on monitoring and assessments of fruit set via models that determine cross-pollination potential using data on bloom progression of ‘Granny Smith’ and pollinator cultivars, honey bee activities, and weather.

Even though female thrips numbers can be very high during early pink to peak bloom, controls are generally not very effective at this time. Thrips numbers can rapidly rebound because many thrips are protected from direct sprays down inside the closed pink buds and flower petals of open blossoms; and, the blossom clusters and young leaves are rapidly growing, so that there is little pesticide residue within two to three days. Also, early sprays may not protect buds that will set fruit. Most results suggest that controlling thrips in the petal fall stage is the most effective because most flowers have been pollinated and young fruitlets are developing. Thrips concentrate in the remaining blossoms and fruit at this time and are more exposed to the insecticides. Better insecticide coverage is achieved on the remaining open blossom and petal fall clusters. However, if *Campylomma* bug is also a problem in the orchard and sprays are required during bloom, some benefit may result from a pink or peak bloom spray.

## Insecticides

A number of pesticides are effective in controlling western flower thrips.

Carzol SP	Minimize bee hazard by spraying before bees are placed in the orchard. Apply late evening or at night if apples are blooming
Thiodan	apply post-bloom only
Guthion	apply post-bloom only

Carzol SP is effective. When bees are in the orchard, it can be used at night during bloom to avoid direct contact with foraging bees. However, Carzol is toxic to predatory mites and frequent use may lead to outbreaks of spider mites. The pesticide activity may not last long as the rapidly growing and maturing blossoms are constantly diluting the chemical residue, and thrips can rapidly move in from untreated areas or other hosts. Thrips populations can rebound in as little as two days. Therefore, monitoring of thrips should continue through petal fall.

## Biological Control

There are a number of predators and parasites that attack western flower thrip. One naturally occurring predator is the minute pirate bug (*Orius* spp.), a small black and white-colored bug with piercing-sucking mouthparts, that can kill thrips larvae and adults. Immature *Orius* nymphs, that are orange-colored and have a pungent odor, are also effective predators. Banded wing thrips are also good predators. As the name suggests the wings of these thrips have dark and light bands, and can be easily distinguished from the western flower thrips. Predaceous mites can be purchased and released to kill thrips. However, these will attack only larval thrips and therefore

are not effective for preventing the damage caused by the ovipositing female. Only those biological controls that target the adult female have any chance of reducing damage, and they must respond quickly when adult female thrips first move into the blossoms.

## Ground cover and weed management

During spring, alternate hosts (clover, weed hosts in nearby fields, other ground covers) should be monitored for the presence of thrips and management of these hosts can help reduce populations in apples. There are a couple of approaches.

1. Plant a highly attractive ground cover such as clover. If it blooms at the time of apple bloom, it may help to dilute the population in apples. However, apple blossoms are still the most attractive host; and, if clover is mowed when full of thrips, thrips will move into apples. Also, if the ground cover blooms long before apples, then it can provide a reservoir of thrips that will move into apples during bloom.
2. No ground cover or repellent ground cover or mulch. This will keep thrips away and not allow them to build up before or during bloom. Some highly reflective UV mulches may repel thrips. These tactics do help in other crops, but have not been tested in apples.

Decisions concerning ground cover must be made in conjunction with other management concerns, such as frost/freeze control, other pests, such as mites, stink bugs, etc. In addition to ground covers, management of weeds, crops, and apple cultivars in adjacent areas may be of benefit, and some of the same issues mentioned above for ground covers will be important.



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